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AUTHOR	Henderson, Joseph
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ABSTRACT

This document presents a two-year community college curriculum for training building construction technicians. The technical content is intended to provide the student with an understanding of building construction and expertise as a member of that industry. The technical skills in construction are to be learned as the student participates in a major construction project such as the actual construction of a residential or commercial building supplementing the in-class sessions. The graduates of the program should be able to work closely and discuss the aspects of building construction with engineers and architects. An outline of the two-year set of courses is followed by descriptions of the construction and supporting technical courses and the supporting general education courses of the program. For each course the number of laboratory and class hours are given as well as a general description, objectives of the course, a course outline, the text to be used, and references. Appended are several bibliographies and a list of suggested visual aids. (Author/LJ)

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STATE OF NEW JERSEY
DEPARTMENT OF EDUCATION
DIVISION OF VOCATIONAL EDUCATION

BUILDING CONSTRUCTION TECHNOLOGY

A Suggested Curriculum

U.S. DEPARTMENT OF HEALTH
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

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Joseph Henderson, Curriculum Specialist
Salem Community College
Penns Grove, New Jersey

State of New Jersey
Department of Education
Division of Vocational Education

BUILDING CONSTRUCTION TECHNOLOGY

A Suggested Curriculum

Prepared by
Joseph Henderson, Curriculum Specialist

Salem Community College
Penns Grove, New Jersey

Vocational-Technical
Curriculum Laboratory
Rutgers — The State University
Building 4103 – Kilmer Campus
New Brunswick, New Jersey

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NEW JERSEY DEPARTMENT OF EDUCATION – FRED G. BURKE, COMMISSIONER

DIVISION OF VOCATIONAL EDUCATION – STEPHEN POLIACIK, ASSISTANT COMMISSIONER

CURRICULUM LABORATORY

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BUILDING 4103 – KILMER CAMPUS

NEW BRUNSWICK, NEW JERSEY

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Joseph Henderson, Chairman
Charles Ahl, Building Construction Instructor
Calvin Birchmire, Physical Science Instructor
William Bittle, Drafting Instructor
Champion C. Coles, Dean of Continuing Education
Herbert C. Donaghay, President
Kenneth Freemark, Architect
William Mark, Academic Dean
Raymond Sickler, Building Contractor
Sam Tillis, Air Conditioning and Refrigeration Instructor

INTRODUCTION

The primary objective of the curriculum recommended in this guide is the training of qualified building construction technicians. As technicians, they will work and communicate directly with other professional personnel. They will be expected to perform as successful employees and to grow into supervisory and administrative positions. In addition, as graduate technicians they will be expected to be well-informed, active, responsible members of society.

To accomplish these goals the curriculum must be carefully planned and implemented. In many ways, more is expected of the 2-year technical graduate than of the 4-year liberal arts graduate.

Consequently, curriculum and courses must be planned for maximum effect. Each course must be designed to develop its particular knowledge and skills and still be closely integrated into the whole curriculum. The sequence of courses is such that each is placed in the most strategic position for its correlation to other courses.

The technical content is intended to provide the student with an understanding of building construction and an expertise as a member of that industry. The technical skills in construction will be learned as the student participates in a major construction project as well as in class sessions. This project should be the actual construction of a residential or commercial building. This, then, will give the student real experiences in the building construction processes, rather than the less desirable simulated experiences in a shop or laboratory. A parallel development will take place in the student's understanding through technical support areas through courses in mathematics, electricity, surveying, and others. To give the student a broad general education, courses in social sciences, English, and the humanities will be given also. The graduate of this program then will be a well-rounded technician who is able to participate in building construction planning as well as participate in the construction itself. The graduates of this program will be able to work closely and discuss the aspects of building construction with engineers and architects, as well as working and coordinating the work with the construction workers. This blend will be a result of technical and general education coupled with a work-oriented experience. Graduates will serve as the effective bridge between theoretical knowledge and practical execution. The graduate will understand sufficiently the professional's scientific and mathematical expression of construction design in order to present tentative and final designs to the construction worker and to supervise the construction. The student will be given special skills and a near-professional level of education, attitude, and competence to achieve this goal.

Graduates of the program can expect to find employment in several fields of building construction such as construction supervision, project management, contracting, estimating, sales, or other areas associated with the construction industry.

ABILITIES AND ACTIVITIES REQUIRED OF BUILDING CONSTRUCTION TECHNICIANS

The following analysis of the special technical abilities and work capabilities required of technicians in several related fields and specialized occupations will give some indication of the special nature of post-secondary, technician education programs.

Special abilities[1] required of technicians are as follows:

1. Proficiency in using scientific method to apply the basic principles, concepts, and laws of physics and chemistry, to the individual's field of technology.

2. Facility with mathematics: ability to use algebra and trigonometry as tools to develop, define, or to quantify; an understanding of, though not necessarily facility with, higher mathematics according to the requirements of the technology.

3. A thorough understanding of the materials, processes, equipment, and techniques commonly used in the technology.

4. An extensive knowledge of the field of specialization, with an understanding of the underlying physical sciences and their application to the engineering activities that distinguish the technology of the field. The degree of competency and the depth of understanding should be sufficient to enable the individual to establish rapport with the managers, architects, or engineers with whom he works, and to enable him to perform a variety of detailed technical work using general procedures or instructions but requiring individual judgment, initiative and resourcefulness in the use of techniques, handbook information, and recorded data.

5. Communication skills that include the ability to record, analyze, interpret, and transmit facts and ideas orally, graphically, and in writing with complete objectivity.

[1] Adapted from *Occupational Criteria and Preparatory Curriculum Patterns in Technical Education Programs*, OE-80015 U.D., Department of Health, Education, and Welfare, Office of Education (Washington: U.S. Government Printing Office, 1962).

Work activities[2] required of the building construction technicians are as follows:

1. Applies knowledge of science and mathematics extensive in rendering direct technical assistance to engineers engaged in construction design and planning.

2. Designs, develops, or plans modifications of construction and techniques or processes under the supervision of engineering personnel in applied research, design, and development.

3. Plans, supervises, or assists in installation, and inspection of installed equipment.

4. Plans production as member of the management unit responsible for efficient use of money, manpower, materials, and equipment in mass production or in routine technical services.

5. Advises, plans, and estimates costs as a field representative of a building contractor.

6. Assists in the performance of tests of mechanical, hydraulic, electrical, or electronic components or systems in the construction process, and the preparation of appropriate technical reports covering the tests.

7. Interprets engineering and architectural drawings and sketches, for work related to the construction technologies.

8. Selects, compiles, and uses technical information from references such as engineering standards, or handbooks, and technical digests of research findings.

9. Analyzes and interprets information obtained from precision measuring and recording instrument and/or from special procedures and techniques, and makes evaluations upon which technical decisions are based.

10. Analyzes and diagnoses technical problems that involve independent decisions. Judgment requires, in addition to technical know-how, substantive experience in the construction field.

11. Deals with a variety of technical problems, involving many factors and variables which require an understanding of several technical fields. This versatility is a characteristic that relates to breadth of understanding applied scientific and technical principles, the antithesis of narrow specialization.

[2] Adapted from *Dictionary of Occupational Titles*, U.S. Department of Labor, U.S. Government Printing Office, Washington, D.C., 1965, Volume 1.

12. Assists in planning and design of building structures and oversees their construction, and may participate in their construction.

13. Estimates materials and costs.

14. Oversees the digging for foundations and raising of structures.

15. Supervises and coordinates activities of workers engaged in construction, installation, and repair of wooden structures and fixtures.

16. Examines blueprints, and makes suggestions for change or alteration as needed, and explains or interprets blueprints for construction workers.

17. Selects materials for use in construction.

18. Inspects work performed by subcontractors to insure conformance with specifications.

19. Determines sequence of activities concerned with erection of a building structure.

CURRICULUM

First Year

Fall Semester		Class	Lab	Credits
MAT 101	Mathematics I	3	0	3*
ENG 101	English I	3	0	3*
DRT 101	Construction Print Reading	0	3	1
PHY 110	Introduction to Electricity and Magnetism	2	3	3*
CT 111	Site Preparation and Construction Development	3	0	3
CT 112	Field Applications I	0	9	3
		11	15	16

Spring Semester				
MAT 102	Mathematics II	3	0	3*
ENG 102	English II	3	0	3*
DRT 102	Isometric Drawing	0	3	1
ELC 111	Electrical Wiring	3	3	4
CT 113	Construction Analysis and Development	3	0	3
CT 114	Field Applications II	0	9	3
		12	15	17

Second Year

Fall Semester				
CT 216	Building Codes	0	3	1
BUS 104	Small Business Management	3	0	3
ACR 101	Interior Climate Control	3	3	4
CT 211	Construction Materials and Procedures	3	0	3
CT 212	Field Applications III	0	9	3
Elective	Social Science Elective	3	0	3*
		12	15	17

Spring Semester				
ENS 104	Surveying	2	3	3
CT 215	Construction Planning, and Estimating	3	3	4
CT 213	Finish Materials and Procedures	3	0	3
CT 214	Field Applications IV	0	9	3
Elective	Humanities Elective	3	0	3*
		11	15	16

*Indicates a General Education Requirement: Total General Education credits = 21 units

Total credits in two year program = 66 units

CONSTRUCTION TECHNOLOGY COURSES

Building Codes (CT 216)

Construction Analysis and Development (CT 113)

Construction Costs and Estimating (CT 215)

Construction Materials and Procedures (CT 211)

Field Applications I, II, III, IV (CT 112, 114, 212, 214)

Finish Materials and Procedures (CT 213)

Site Preparation and Construction Development (CT 111)

Building Codes
(CT 216)

Hours Required: Class 0, Lab 3

Description: A course designed to deal with the intricate requirements of the National and Local Building Codes.

Objective: To enable the student to clearly interpret the various building codes in the field.

I. Administration and Enforcement
   - A. Building officials
   - B. Rules and regulations
   - C. Inspections
   - D. Permits
   - E. Boards of survey
   - F. Boards of appeal

II. Definitions and Classifications
   - A. General definitions
   - B. Group classifications
   - C. Types of buildings
   - D. Construction classifications

III. Building Limitations
   - A. Fire restrictions
   - B. Area and height limitations
   - C. Encroachments
   - D. Projections

IV. Special Uses
   - A. Hazardous uses
   - B. Combustible storage
   - C. Public assemblies
   - D. Trailer camp
   - E. Motels

V. Lighting and Ventilation
   - A. Standards of natural lighting
   - B. Standards of natural ventilation
   - C. Stairways and exits
   - D. Institutional buildings
   - E. Emergency ventilation

VI. Egress
- A. Definitions
- B. Types required in different buildings
- C. Capacities required

VII. Loads and Stresses
- A. Safe loads
- B. Test loads
- C. Types of loads and requirements
- D. Working stresses

VIII. Materials and Tests
- A. Classification
- B. Types of testing
- C. Conditions of acceptance
- D. Approvals

IX. Construction Types
- A. Steel
- B. Masonry
- C. Concrete
- D. Gypsum
- E. Lumber

X. Walls and Enclosures Requirements
- A. Protection
- B. Thickness required
- C. Water proofing
- D. Fire protection
- E. Insulating materials

XI. Fire Resistive Construction
- A. Hazardous classifications
- B. Fire resistive tests
- C. Flame resistive tests
- D. Fire partitions
- E. Supports
- F. Restrictions

XII. Heating and Appliances
- A. Inspection and tests
- B. Mounting exceptions
- C. Air ducts
- D. Industrial systems

1-1

XIII. Fire Protection Equipment
- A. Plans and specifications
- B. Acceptance tests
- C. Stand pipe requirements
- D. Fire lines
- E. Sprinkler systems
- F. Alarm systems

XIV. Plumbing
- A. Plumbing principles
- B. Plans and specifications
- C. Permits and approvals

XV. Pre-fabricated Construction
- A. Test of assemblies
- B. Pre-fabricated units
- C. Materials and methods of fabrication

Test: *B.O.C.A. Basic Building Code*, Building Officials Conference of America, Inc., 1970 Edition, plus yearly supplements

References: Local building codes.

Construction Analysis and Development
(CT 113)

Hours Required: Class 3, Lab 0

Description: An in-depth study of construction designs and methods. Materials and methods of the three major categories of construction are studied individually showing structural advantage and capabilities of each. Roof framing and structural design of each type will be studied in their various applications to each major division.

Objective: This course presents the basic differences between the various major construction designs. Emphasis is placed on design and bearing load displacement. Roof structure and design is studied in depth to enable the student to determine proper roof design for maximum efficiency and effectiveness.

I. Introduction
  A. Site safety
    1. Scaffolds
      a. Classifications
      b. Applications and uses
      c. Erecting scaffolds
      d. Moving scaffolds
    2. Procedures
    3. Site hazards and remedial actions
    4. Special equipment
      a. Elevators and lift equipment
        1. Manual and power lifts
        2. Elevators
      b. Excavating equipment

II. Masonry and Concrete Wall Construction
  A. Bearing walls and load displacement
    1. Plaster and wall column
      a. Reinforcing
    2. Form construction
      a. Bracing methods
      b. Studs and whalers
      c. Portable forms
        1. Care and uses
  B. Reinforcing and Stabilization
    1. Rod reinforcing standards
      a. Installation methods

2. Ties and temporary supports
   a. Snap-on form stabilization
3. Reinforcing mesh (steel)
   a. Standards and applications

C. Material Handling and Installation
1. Site preparation of material
   a. Methods and equipment
2. Displacement
   a. Portable equipment
   b. Density requirements
      1. Federal and State standards

D. Surface Finish Standards
1. Applications
   a. Special finish procedures
2. Methods

E. Form and Support Removal
1. Procedures
2. Care of portable forms
   a. Preservation and storage

F. Repairing Structural Defects
1. Inconsistent material displacement
2. Construction damage

III. Structural Steel and Concrete
A. Column supports
1. Load bearing capacities
2. Federal and State standards

B. Footing and Load Bearing Supports
1. Piling
2. Spread footings
3. Drainage
4. Soil stabilization

C. Steel Erection
1. Support
2. Methods and materials
3. Span specifications

D. Non-Load Bearing Walls
1. Poured concrete
2. Block
3. Transite and metal

IV. Exterior Wood Frame Construction
- A. Framing methods and material
  - 1. Western or platform method
    - a. Advantages
    - b. Major application
    - c. Procedures
  - 2. Balloon framing
    - a. Advantages and uses
    - b. Firestops and ledgers
  - 3. Plank and beam
    - a. Procedures
    - b. Major applications
  - 4. Pole barn construction
    - a. Methods and materials
- B. Sill and Floor Supports
  - 1. Moisture barriers
  - 2. Termite control
  - 3. Standard fastening procedures
  - 4. Weight distribution
  - 5. Load bearing capacities
    - a. State and local standards
- C. Exterior Wall Construction
  - 1. Layout and preparation
    - a. Code requirements
    - b. Materials
  - 2. Perimeter walls
    - a. Plates, studs, and headers
    - b. Construction methods
  - 3. Load bearing walls
    - a. Beams and headers
    - b. Span requirements
    - c. Opening standards
    - d. Construction and erection
    - e. Stabilization
- D. Ceiling Support Framing
  - 1. Ceiling joist
    - a. Span requirements
    - b. Size standards
    - c. Installation methods
- E. Roof Framing
  - 1. Designs and applications
    - a. Types
      - 1. Gable
      - 2. Gambral
      - 3. Mansard
      - 4. Shed

b. Load bearing capacity
c. Weather control capacity
d. Pitch
e. Drainage
f. Temperature range
g. Architectural application
h. Surface integrity

2. Roof Construction
   a. Structural implementation
      1. Code requirements
      2. Materials
      3. Layout and installation
      4. Fastening

3. Roof Stabilization
   a. Bracing
      1. Truss brace
      2. Collar tie

4. Prefabricated Systems
   a. Structural advantage
   b. Installation
   c. Open span load displacement

V. Wall and Piers

A. Bearing Beam Supports
   1. Span supports
      a. Footing design
      b. Stabilization
      c. Construction methods
         1. Block
         2. Poured concrete
         3. Steel column

B. Girder Supports
   1. Methods and applications
      a. Jock post support
         1. Footing specifications
      b. Block column
      c. Poured column

C. Bearing Wall Construction
   1. Support footing specifications
      a. Preparation
      b. Reinforcing
      c. Installation
      d. Drainage

2. Bearing wall construction
   a. Methods and material
      1. Block construction
      2. Poured concrete
   b. Wall reinforcement
      1. Rod reinforcement
      2. Block wall stabilization
3. Below grade retaining walls
   a. Areaways
      1. Excavations
      2. Layout and preparation
      3. Drainage
      4. Installation
      5. Surface finishes
   b. Retaining walls
      1. Construction and installation
      2. Reinforcement
      3. Below grade supports

VI. Post and Beam Concept
   A. Load Distribution
      1. Subgrade supports
      2. Beam span requirements
      3. Post dimension specifications
   B. Applications
      1. Structural advantage
         a. Open span
         b. Cathedral ceilings

Text: Wagner, Willis H., *Modern Carpentry*. Goodheart-Wilcox, South Holland, Illinois. 1969.

References:

National Lumber Manufacturers Association, *National Design Specifications for Stress-Grade Lumber and Its Fastenings.*

National Lumber Manufacturers Association, *Wood Structural Design Data.*

Shedd, *Structural Design in Steel.*

Shedd and Vawter, *Theory of Simple Structures.*

Southern Pine Association, *Modern Timber Engineering.*

Ulrey, Harry, *Carpenters and Builders Library*. 3rd ed., 4 vol., Audel Div. of Howard W. Sams. Indianapolis, Indiana. 1970.

Construction Costs and Estimating
(CT 215)

Hours Required: Class 3, Lab 3

Description: An introduction to the methods of estimating the costs of construction materials and labor using specifications, construction prints, and detailed drawings. Building projects are analyzed with respect to overhead expenses, profits, and contracts in terms of small businesses.

Objectives: To provide the student with information and procedures used in the preparation of construction cost estimates. To provide an experience in calculating total and unit cost figures. To enable the student to make quick, accurate, quantity take-offs and labor-time estimates.

I. Introduction

II. Specifications and Drawings
- A. Working Drawings
- B. Written Specifications
  1. Specified material and suitable substitutes
     - a. Responsibilities of architect
  2. Material take-off (specifications)
  3. Cost calculations of materials
     - a. Market price fluctuations
     - b. Fixed dealer prices
     - c. Shipping and handling costs
- C. Review of Construction Prints
  1. Symbols
  2. Dimensions

III. Measures
- A. Square Foot Measure
  1. Exterior surface covering
  2. Masonry surface finishing
  3. Interior insulation
  4. Wall ceiling and floor coverings
- B. Cubic Measure
  1. Loose bulk building materials
     - a. Concrete
     - b. Soil fills
     - c. Stone

C. Running Foot Measure
   1. Decorative trims
   2. Metal moldings
   3. Reinforcing rod and mesh

D. Board Foot Measure
   1. Framing lumber
   2. Finish lumber
   3. Flooring
   4. Wood siding

E. Unit Priced Materials
   1. Structural masonry components
      a. Block
      b. Brick
      c. Tile
      d. Stone
   2. Windows and Doors
      a. Door frames
      b. Storm doors and windows
      c. Hardware and accessories

IV. Surveying and Excavation
   A. Post Determination
      1. Volume of materials
      2. Disposition of excavated materials
      3. Equipment required
      4. Manpower requirements
      5. Cost rate (machine and operator)

   B. Subcontract method
      1. Contractors estimate
         a. Time and material
         b. Contract price

   C. Land Fill Requirements
      1. Finish elevation
      2. Cost and availability
      3. Subgrade preparation

V. Concrete
   A. Volume Determination
      1. Cost per unit
      2. Quantity take-off
         a. Form method
         b. Free flow method

B. Additional Installation Costs
   1. Special preparations
   2. Equipment requirements
   3. Site accessibility
      a. Transportation costs
C. Labor Cost Analysis
   1. Man hours required
   2. Classifications and rates
   3. Overtime and overtime pay

VI. Framing, Millwork, and Roofing
A. Material Take-off Methods
   1. Standard procedures
   2. Custom millwork rates
      a. Cost determination
B. Labor Cost Calculation
   1. Rate of reimbursement
   2. Man hour requirements
   3. Sub-contract price

VII. Masonry
A. Unit Requirement Determination
   1. Calculation methods
      a. Bonding materials estimating
      b. Availability
      c. Freight and handling
   2. Labor costs
      a. Access equipment erection
      b. Cost per unit
      c. Reimbursement rates
      d. Man hour determination
      e. Clean-up and tear down

VIII. Wet and Dry Walls
A. Material Take-Off
   1. Wet wall calculation
      a. Square foot measure
   2. Dry wall cost calculation
      a. Square foot method
      b. Unit method
      c. Man hour method
      d. Material joint ratio

B. Labor Cost Estimating
   1. Time and material
   2. Contract job price
   3. Unit price method

IX. Electrical Supplies
   A. Calculation of Material Needs
      1. Cost analysis
         a. Supplies estimates
      2. Unit price method
      3. Special costs and fees
         a. Estimate cost
         b. Survey fees
         c. Inspection fee
   B. Labor Cost Analysis
      1. Subcontract fees
      2. Time and material
      3. Unit price method

X. Special Interior Finishes
   A. Flooring
   B. Paneling
   C. Ceiling tiles
   D. Ceramic tile
   E. Wallpaper and wall treatments
   F. Glass

XI. Paint and Hardware
   A. Analysis of Material Needs
      1. Square foot coverage
         a. Paint
         b. Varnish
         c. Sealers
      2. Volume purchases
         a. Volume discounts
      3. Determination of unit requirements
         a. Rough hardware
            1. Fasteners
            2. Reinforcing
         b. Finish hardware
            1. Locks
            2. Hinges
            3. Decorative effects

XII. Windows and Doors
- A. Unit Requirements
  1. Specifications
  2. Substitutions
  3. Standards
  4. Installation and finish hardware
- B. Installation Costs Estimating
  1. Subcontract price
  2. Man hour rates
  3. Time requirements

XIII. Plumbing
- A. Standard Take-Off Methods
  1. Pipe and fitting calculation
  2. Supplies and equipment
  3. Trim and fixture specifications
- B. Labor Cost Analysis
  1. Time and material method
  2. Estimated costs
  3. Unit price method

XIV. Interior Climate Control
- A. Equipment Requirement Calculation
  1. Major unit specifications
     a. Capacity requirements
  2. Circulation methods
     a. Material computation
  3. Finish fixtures and trim
     a. Outlets, diffusers, decorative coverings
- B. Installation Cost Analysis
  1. Factory installed units
  2. Subcontractor costs
  3. Time and material calculations

Text: Steinberg, Joseph and Stempel, Martin, *Estimating for the Building Trades*, 2nd ed., American Technical Society, Chicago, 1965.

References: Bateman, *Materials of Construction*.

Cooper, George H., *Building Construction Estimating*, 3rd ed., McGraw-Hill, New York, 1971.

Foster, Norman, *Construction Estimates from Take-Off to Bid*, McGraw-Hill, New York, 1961.

Huntington, Whitney C., *Building Construction*, 4th ed., John Wiley and Sons, New York, 1974.

Merritt, Frederick, *Building Construction Handbook*, McGraw-Hill, New York, 1965.

Peurifoy, Robert L., *Estimating Construction Costs*, McGraw-Hill, New York, 1958.

Wynne, George, *Building Estimating*, Charles E. Merrill Pub., Columbus, Ohio, 1973.

Construction Materials and Procedures
(CT 211)

Hours Required: Class 3, Lab 0

Description: This course spans all areas of construction support framing. Beginning with load bearing supports and proceeding to roof frame construction, all structural methods are studied showing advantage and capabilities of each. The course follows the sequence of construction. Each division in the sequence is studied in depth showing the necessity for correct job planning and construction scheduling. Special attention is given to the divisions of plumbing, electricity, and ventilation. Roof surface finishes are studied with attention to application, methods, and materials of each.

Objective: The primary objective of this course is to enable the student to select proper support methods and implement their applications to the major divisions of construction. The student will gain the insight required to enable proper scheduling of the allied trade areas necessary to the expedient completion of a construction project. A study in selection and installation of approved roofing methods will enable the student to select proper methods and materials for maximum efficiency.

I. Safety Practices
   A. State and Federal Standards
      1. Equipment
      2. Standard procedures

II. Flooring
   A. Sills
      1. Foundation bond
      2. Insect control
      3. Installation methods
   B. Headers
      1. Joist perimeter
         a. Fastening methods
      2. Open access areas (stairwells)
         a. Headers and sleepers
         b. Bearing specifications
      3. Code requirements
         a. Bearing load capabilities
         b. Open span regulations

C. Floor Supports
   1. Girders, laminated beams
      a. Span supports
      b. Approved fastening methods
      c. Span specifications
   2. Joist
      a. Code span requirements
      b. Material selection
      c. Fastening and bracing
      d. Bridging (load displacement)
   3. Sub-finish floors
      a. Materials and methods
         1. Specifications
            a. Code requirements
         2. Fastening

III. Interior Wood Frame Construction
   A. Bearing Wall Construction
      1. Header specifications
      2. Span requirements
      3. Construction and erection
      4. Bearing point placement
   B. Ceiling Support Construction
      1. Span dimension specifications
         a. Code on center requirements
      2. Bearing frame stabilization
         a. Joist rafter truss
            1. Center span bracing
      3. Open ceiling construction
         a. Load displacement
            1. Alternate frame bracing
   C. Non-Bearing Wall Construction
      1. Code requirements
         a. Dimensional specifications
         b. Header requirements
         c. On center standards
      2. Construction methods & materials
         a. Selection of materials
         b. Layout
            1. Provisions for openings
         c. Construction and installation
   D. Free Standing Wall Construction
      1. Methods of vertical support
      2. Support at openings

E. Preparation for Finish Surfaces
1. Fastening provisions
a. Nailers inside corners
b. Nailers across interior walls
2. Interior wall stabilization
a. Studs and nailers

IV. Framing Enclosure
A. Methods and Materials
1. Municipal code requirements
a. Material density
b. Insulating properties
c. Stabilization qualities
d. Fire code ratings
2. Installation
a. Applications characteristics
b. Methods of fastening
c. Handling and installation
3. Exterior frame bracing
a. Bracing qualities
b. Maximum effectiveness

V. Plumbing
A. Code requirements and specifications
1. Municipal sewage treatment
a. Drain dimension specifications
b. Drain elevation requirements
c. Drainline slope
2. Self contained sewage disposal
a. Septic tank and cesspool specifications
b. Soil absorption qualities
c. Overflows and field drains
1. Material code requirements
3. Municipal water
a. Main line specifications
1. Volume consumption
4. Independent water supply
a. Dug well
1. Water testing
2. Standards (state and local)
3. Extraction and circulation
b. Deep and shallow pipe wells
1. Specifications
a. Volume
b. Testing
c. Cleaning

2. Extraction and circulation

5. Interior rough in requirements
   a. Feed line specifications
      1. Approved fabrication methods
      2. Standard rough in procedures
      3. Valves and fittings
   b. Drain standards
      1. Volume capabilities
      2. Slope requirements
      3. Ventilation
      4. Traps and clean outs

VI. Electrical Wiring
   A. Rough in Wiring
   B. Switches and Outlets
   C. Testing
   D. Inspection

VII. Ventilation (H.V.A.C.)

Text:

Wagner, Willis H., *Modern Carpentry*, Goodheart-Wilcox, South Holland, Illinois, 1969.

References:

Carson, Arthur, *General Excavation Methods*, McGraw-Hill, New York, 1961.

McKaig, Thomas H., *Field Inspection of Building Construction*, McGraw-Hill, New York, 1958.

Peurifoy, Robert L., *Construction Planning, Equipment, and Methods*, McGraw-Hill, New York, 1970.

Ulrey, Harry, *Carpenters and Builders Library*, 3rd ed., 4 vol., Audel Div. of Howard W. Sams, Indianapolis, Indiana, 1970.

Field Applications I, II, III, IV
(CT 112, 114, 212, 214)

Hours Required: Class 0, Lab 9 each semester

Description: A laboratory class implementing the theories, ideas, and skills learned in the Construction classes. This four semester lab course will give the student experiences in the actual construction processes. The student will participate in a major building construction project for this lab course.

Objectives: To give the student the opportunity to participate in the construction of a building and to learn first-hand the skills and techniques of building construction. To acquaint the student with the problems and development of building construction.

Foreword: The student will be required to maintain an up-to-date notebook of the lab experiences in this course. It is noted here, that building construction is an on-going process and that the experiences listed in this course may not necessarily be taken sequentially. However, this possibility will not destroy the continuity nor the effectiveness of the program. Factors which may affect the sequence presented here are climatic conditions and limited on-site opportunities that may necessitate simulated experiences in a shop or laboratory.

I. Site Selection
   - A. Comment and Review of Sites
     1. Condition
     2. Relationship to the building
     3. Clearing requirements
     4. Fill requirements
     5. Utility requirements
   - B. Building Code and Zoning Requirements
   - C. Batter Boards Installation

II. Foundation Elements
   - A. Excavating
   - B. Reinforcing
   - C. Forming
   - D. Footing Construction
     1. Reinforcing
     2. Pouring

III. Foundation Construction
   A. Masonry and Concrete Foundations
      1. Types
      2. Shoring
      3. Forming
      4. Construction

IV. Ordering Materials
   A. Visits to Material Suppliers
   B. Material Take-Off
   C. Material Storage at Site

V. Site Safety
   A. Scaffolds
   B. Equipment Location
      1. Cutting tables

VI. Exterior Wall Construction
   A. Layout
   B. Starting Procedures
   C. Placement
      1. Frame
      2. Masonry
      3. Steel
   D. Sheathing Wall Construction

VII. Roof System Construction
   A. Design and Construction of Ceilings
      1. Layout
      2. Installation
   B. Roof Construction
      1. Layout
      2. Installation
      3. Bracing
      4. Safety
         a. Weather condition factors
         b. General safety practices
      5. Sub-roof cover

VIII. Flooring
   A. Residential
      1. First and second floor joists
      2. Subflooring (This will occur at the same time as Exterior Wall Construction – Section VI)

B. Commercial
   1. Steel
   2. Wood
   3. Concrete

IX. Interior Wall Construction
   A. Residential
      1. Interior bearing partitions (This will occur at the same time as Exterior Wall Construttion – Section VI)
      2. Non-bearing partitions
   B. Commercial
      1. Load bearing walls
      2. Non-load bearing walls
      3. Mechanical chases

X. Plumbing
   A. Code Requirements and Specifications
   B. Water and Sewer Services
   C. Underground Rough-in Requirements
   D. Above ground Rough-In Requirements
   E. Tests and Inspections

XI. Heating-Cooling (Interior Climate Control)
   A. Forced Air
      1. Layout
      2. Duct rough-in
   B. Water
      1. Layout
      2. Pipe distribution rough-in
   C. Electric
      1. Layout
      2. Electrical rough-in
   D. Tests and Inspections

XII. Electrical System
   A. Layout
   B. Box Rough-In
   C. Wire Routing and Wire Rough-In
   D. Tests and Inspections

XIII. Construction Finishing
- A. Residential
  1. Roof
  2. Exterior walls
  3. Exterior trim
     a. Windows
     b. Doors
     c. Soffit
     d. Miscellaneous
  4. Insulation
  5. Interior walls
  6. Flooring
  7. Interior trim
     a. Trim
     b. Doors
     c. Cabinets
     d. Stairs
  8. Electrical and mechanical finishes
     a. Electrical finishes
     b. Plumbing finishes
     c. Heating and air conditioning finishes
  9. Decorating
     a. Exterior
     b. Interior
  10. Exterior site finishing
     a. Grading
     b. Seeding
     c. Landscape
     d. Drives and walks
  11. Construction clean-up
  12. Inspection
     a. Electrical
     b. Plumbing
     c. Heating
     d. General building
  13. Client inspection and acceptance
- B. Commercial
  1. Roof
  2. Exterior walls
  3. Exterior trim
     a. Windows
     b. Doors
     c. Soffit
     d. Miscellaneous

4. Insulation
5. Interior walls
6. Stairs
7. Interior trim
   a. Doors and trim
   b. Paneling
   c. Special applications
8. Interior ceilings
   a. Acoustical suspended
   b. Special applications
9. Miscellaneous items
   a. Toilet partitions
   b. Office partitions
   c. Built-ins
      (1) Cabinets
      (2) Special applications
   d. Signs
10. Flooring
11. Electrical and mechanical finishes
   a. Electrical finishes
   b. Plumbing finishes
   c. Heating and air conditioning finishes
   d. Electrical and mechanical start-ups
12. Construction clean-up
13. Decorating
   a. Exterior
   b. Interior
14. Exterior site finishing
15. Inspection
   a. Electrical
   b. Plumbing
   c. Heating
   d. General building
16. Client inspection and acceptance

XIV. Program Evaluation and Critique

A. Evaluation and Critique of First Semester

B. Evaluation and Critique of Second Semester

C. Evaluation and Critique of Third Semester

D. Evaluation and Critique of Fourth Semester

Finish Materials and Procedures
(CT 213)

Hours Required: Class 3, Lab 0

Description: A study in the selection and application of finish and decorative construction materials. This course spans the gamut of finish construction materials and methods from exterior coverings and finishes to interior surface preparation, installation, and finishing. The finishing procedures of all allied craft areas are studied with special attention to plumbing, electricity, and decorative masonry. Procedures, methods, and materials of site landscaping are studied with respect to proper selection of applications to various construction designs.

Objective: The student will gain the required basic knowledge to enable him to select, acquire, and install finish materials common to the construction industry. He will acquire a basis for judgment necessary in the selection of materials with respect to architectural design and market availability. Skill in allied trade scheduling is a primary objective of this course enabling the student to coordinate finish construction activities.

I. Safety Procedures Finish Construction
   - A. Tool and Equipment Handling
     1. Motor driven power tools
        - a. Safe operating procedures
     2. Hand tool safety
        - a. Care and handling
        - b. Preventative maintenance
   - B. Personal Safety Equipment
     1. Clothing and footwear
     2. Eye protection
     3. Construction helmets and bump caps
   - C. Preventative Procedures
     1. Proper work setup
        - a. Housekeeping
        - b. Material storage
        - c. Warning signs and safety rails

II. Exterior Wall Finishes
   - A. Siding
     1. Metal
     2. Wood
     3. Laminates
     4. Vinyls
     5. Compositions

B. Masonry Exterior Wall Finishes
   1. Decorative block
   2. Block
   3. Stucco overblock
   4. Stone
   5. Block (masonry)

C. Installation Procedures
   1. Mechanical fastening devices
      a. Metal
      b. Plastic
   2. Adhesives
      a. Special applications
   3. Masonry mortar procedures
      a. Wall lock and wall ties
      b. Reinforcement
      c. Structural capabilities
      d. Decorative effects

D. Cornice and Eave Treatments
   1. Preparation
   2. Ventilation
   3. Eave box components
      a. Facia
      b. Soffitt
      c. Returns
   4. Exterior moldings

III. Roof Finishing
   A. Preparation and installation
      1. Undersurface preparation
      2. Layout of surface materials
      3. Material handling
      4. Installation procedures

   B. Integration of adjacent surface
      1. Valley applications
         a. Bonded flashing
         b. Woven valley system
      2. Ridge cap
      3. Flashing methods
         a. Chimney treatments
         b. Adjacent wall flashing
         c. Counter flashing
      4. Roof drain application

IV. Exterior Surface Integrity
- A. Weather Proofing of Joints and Seams
  1. Window and door frame installation
  2. Sidings and trim
- B. Surface Preparation of Untreated Surfaces
  1. Caulking
  2. Sealing
  3. Staining
- C. Finish and Preservation
  1. Sealing masonry surfaces
  2. Decorative surface finishes
     a. Paint
     b. Silicone
     c. Varnish
     d. Stain

V. Insulation
- A. Specification
  1. Utility standards
  2. Local and state specifications
- B. Material Selection
  1. Analysis of heat gain calculation
  2. Installation properties and materials
- C. Installation Methods and Materials
  1. Perimeter wall applications
  2. Ceiling and roof treatments
  3. Floor installation methods

VI. Interior Wall Finishes
- A. Material Selection
  1. Architectured design
  2. Standard procedures
  3. Availability
- B. Application Methods
  1. Surface preparation
  2. Finish material applications
  3. Decorative surface finishes
- C. Trim and Decorative Effects
  1. Standard procedures
  2. Special design effects

VII. Floor and Ceiling Finishes
- A. Flooring Methods and Materials
  - 1. Selection of materials
    - a. Concrete
    - b. Ceramic tiles
    - c. Handwood
    - d. Blocktile
    - e. Inlaid
  - 2. Installation methods
    - a. Tools and equipment
    - b. Adhesives
    - c. Fasteners
- B. Ceiling Methods and Materials
  - 1. Material selection
    - a. Specifications
    - b. Availability
  - 2. Procedures of installation
    - a. Equipment
    - b. Layout
    - c. Application

VIII. Interior Decorative Components
- A. Window and Door Trim
  - 1. Standard practices
  - 2. Material availability
  - 3. Installation methods
- B. Ceilings and Base Moldings
  - 1. Procedures
  - 2. Materials
  - 3. Installation
- C. Decorative Trim Applications
  - 1. Mantel trim
  - 2. Stair trim treatments
  - 3. Exposed beam trim
  - 4. Raised or recessed panels

IX. Exterior Site Finishing
- A. Sub Grade Landscraping
  - 1. Surface drainage
  - 2. Environmental preparation
  - 3. Landscaping methods and materials
- B. Finish Grade Treatment
  - 1. Soil applications
  - 2. Treatment

3. Installation of sod systems
4. Seeding and care

C. Shrubs and Trees
1. Selection
2. Installation and fertilization
3. Maintenance

Text: Wagner, Willis H., *Modern Carpentry*, Goodheart-Wilcox, South Holland, Illinois, 1969.

References:

Carson, Arthur, *General Excavation Methods*, McGraw-Hill, New York, 1961.

McKaig, Thomas H., *Field Inspection of Building Construction*, McGraw-Hill, New York, 1958.

Peurifoy, Robert L., *Construction Planning, Equipment, and Methods*, McGraw-Hill, New York, 1970.

Ulrey, Harry, *Carpenters and Builders Library*, 3rd ed., 4 vol., Audel Division of Howard W. Sams, Indianapolis, Indiana, 1970.

Site Preparation and Construction Development
(CT 111)

Hours Required: Class 3, Lab 0

Description: An introductory study of materials and methods of construction dealing with support footings and foundations. It includes an introduction to soil testing, methods of obtaining maximum load capabilities, and methods and materials for reinforcing concrete.

Objective: A principal objective of this course is to develop in the student a basis for judgment in determining load bearing capabilities of soil in relationship to foundation and footing design.

Laboratory exercises will consist of testing soil, layout and excavation, and foundation construction methods and materials.

I. Introduction
   - A. Safety
     1. Employers' responsibilities
     2. Employees' responsibilities
     3. State & Federal regulations
     4. Safety equipment and uses
   - B. Tool Handling
     1. Care and maintenance
     2. Uses and storage
     3. Hand tool safety

II. Site Planning and Selection
   - A. Zoning Regulations
   - B. State, County & Municipal Regulations
   - C. Building Code Requirements
   - D. Legal Aspects
     1. Liens
     2. Right of way
     3. Variances
     4. Insurance rates
   - E. Access to Utilities
   - F. Elevation of Land
     1. Fill limits and requirements
   - G. Tax Rates

III. Building Plans and Specifications
- A. Codes and Regulations
- B. Acquisition of Permits
- C. Financing
- D. General Contractors
  1. Subcontractors
- E. Acquisition of Building Plans

IV. Structural Design of Foundation Elements
- A. Column Footings
  1. Pier supports
  2. Forms
- B. Wall Footings
  1. Excavating
  2. Reinforcing
  3. Forming
- C. Retaining Walls
  1. Below grade living areas
     a. Forming
     b. Pouring & stripping
     c. Sealing

V. Subsurface Material
- A. Structure and Consistency
  1. Properties of soil and rock
  2. Permeability
  3. Water content & drainage

VI. Foundation Types and Construction
- A. Excavation
  1. Stabilization
  2. Drainage
  3. Underpinning & shoring
- B. Poured Concrete
  1. Layout
  2. Forms
  3. Reinforcing
  4. Specifications of materials
- C. Pile Foundations
  1. Pile caps
  2. Footing supports
  3. Specifications

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D. Block Foundations
   1. Material specifications
   2. Bonding and construction
   3. Reinforcing

VII. Footing and Foundation Installation
   A. Determining Specifications
      1. Proctor test
      2. Soil consistency
      3. Moisture conditions
   B. Excavation
      1. Shoring and forming
      2. Drainage
         a. Removing subsurface water
   C. Footing Installation
      1. Reinforcing
         a. Specifications
      2. Pouring
      3. Surface finishes
   D. Foundation Construction
      1. Block and brick
         a. Mortar
         b. Reinforcing
         c. Weather proofing
      2. Poured foundations
         a. Forms
            1. Shoring and bracing
            2. Construction
            3. Reinforcing
      3. Support pier
         a. Construction

Text: Wagner, Willis H., *Modern Carpentry*, Goodheart-Wilcox, South Holland, Illinois, 1969.

References: Carson, Arthur B., *General Excavation Methods*, McGraw-Hill, New York, 1961.

McKaig, Thomas H., *Field Inspection of Building Construction*, McGraw-Hill, New York, 1958.

Peurifoy, Robert L., *Construction Planning, Equipment, and Methods*, McGraw-Hill, New York, 1970.

Ulrey, Harry, *Carpenters and Builders Library*, 3rd ed., 4 vol., Audel Division of Howard W. Sams, Indianapolis, Indiana, 1970.

SUPPORTING TECHNICAL COURSES

Construction Print Reading (DRT 101)

Electrical Wiring (ELC 111)

Interior Climate Control (ACR 101)

Isometric Drawing (DRT 102)

Small Business Management I (BUS 104)

Surveying (ENS 104)

Construction Print Reading
(DRT 101)

Hours Required: Class 0, Laboratory 3, Credit 1

Description: A course in the interpretation, preparation, and utilization of construction prints and sketches. Includes study and use of current and proposed building plans.

Objective: To provide the student with the fundamental abilities to clearly interpret construction prints.

I. Working Drawings
   - A. Defined
   - B. How Produced
   - C. Types

II. Reading Drawings
   - A. Pictorial
   - B. Perspective
   - C. Isometric
   - D. Oblique
   - E. Orthographic

III. Elevation Drawings
   - A. Design of Building
   - B. Roof
   - C. Openings
   - D. Exterior Finish
   - E. Materials

IV. Floor Plans
   - A. Basic Ideas
   - B. One Story
   - C. Two Story
   - D. One and One-Half Story

V. Symbols
   - A. Material and Building Parts
   - B. Abbreviations

VI. Scaling and Dimensioning
- A. Drawing to Scale
- B. Architect's Scale
- C. Use of Folding Rule
- D. Dimensions by Direct Measurements
- E. Dimension Standards
- F. Dimensioning Methods for Windows and Doors

VII. Structural Information
- A. Where Found
- B. Construction Types
- C. Unit Construction
- D. Framing
- E. Prefabricated

VIII. Detail Drawing
- A. Interior Elevations
- B. Structure
- C. Windows and Doors
- D. Exterior and Interior Trim

IX. Plot Plan
- A. Survey Plot
- B. Plot Plan
- C. Elevations
- D. Contour Lines

Text: Sundberg, Elmer W., *Building Trades Blueprint Reading*. 5th Edition. American Technical Society, Chicago, Illinois.

References: Coover, Shivet L., *Drawing and Blueprint Reading*. McGraw-Hill Book Co., Inc., New York, N.Y.

Horning, William J., *Blueprint Reading*. Prentice-Hall, Inc., Englewood Cliffs, New Jersey.

Olivo, Thomas C., and Payne, Albert V., *Basic Blueprint Reading and Sketching*. Delmar Publishers, Inc., New York, N.Y.

Electrical Wiring
(ELC 111)

Hours Required: Class 3, Lab 3

Description: Fundamentals of electrical wiring are explored and developed. Consideration is given to wiring needs and requirements as applied to residential structures. The basic skills of electricity and the wiring of electrical service are set forth together with the use of the tools and equipment.

Objectives: The objectives of this course are to acquaint the student with the materials, tools, and safety requirements of electrical wiring prodedures, and to give the student a working knowledge of electrical wiring installation.

I. Fundamentals of Electricity
   - A. Definitions
     1. Electricity
     2. Amperage
     3. Wattage
     4. Voltage
     5. Voltage drop
     6. Series circuit
     7. Parallel circuit
   - B. Symbols Used in Architectural Plans
   - C. Phases and Cycles
   - D. Voltage
   - E. Grounding
   - F. Service Equipment
   - G. Protective Devices

II. Wiring Materials, Tools, and Devices
   - A. Wire Sizes
   - B. Insulation
   - C. Cable With Flexible Metal Covering
   - D. Cable With Non-Metallic Covering
   - E. Lead Sheathed Cable
   - F. Trench Cable
   - G. Lamp Cord
   - H. Rigid Conduit

I. Thin-Wall Conduit
J. Outlet Boxes
K. Single-Pole Toggle Switch
L. Double-Pole Switch
M. Three-Way Switch
N. Four-Way Switch
O. Door Switch
P. Mercury Switch
Q. Delayed-Action Switch
R. Outlet Receptacles
S. Fuses and Circuit Breakers
T. Fustats
U. Duplex Convenience Outlet
V. Tools
1. Basic tools
2. Amp probe
3. Ohm meter
4. Voltage tester

III. Splices and Connections
A. Rules
B. Forming Eyes
C. Western Union Splice
D. Center Taps
E. Pigtail Splices
F. Solderless Connection
G. End Taps
H. Soldering Splices
I. Taping Splices

IV. Installing Residential Electrical Service
A. Determining Number Needed and Locations of Outlets
B. Installing Conduit
C. Installing Armored Cable
D. Installing Non-Metallic Cable
E. Plug Molding
F. Making Connections
G. Wiring Switches

H. Series and Parallel Wiring
I. Outlet Installation
J. No-Shock Outlets
K. Switch and Receptacle Combinations

V. Service Requirements
A. Wiring for 120 V and 240 V
B. Service Entrance Requirements
C. Grounds and Ground Fault Devices
D. Determining Number of Circuits
E. General Purpose Circuits
F. Appliance Circuits
G. Conduit Size
H. Number of Wire Permitted in Boxes
I. Individual Equipment Circuits
J. Servo Control Circuits

VI. Installing Electrical Heating Systems
A. Types of Electrical Heating Systems
B. Installation

VII. Underwriters Requirements
A. Fire underwriters manual
1. Residential requirements
2. Other related requirements

Text: Richter, H.P., *Practical Electrical Wiring*, 8th Edition, 1970, McGraw-Hill Book Company, New York, N.Y.

References: Graham, Kennard C., *Interior Electrical Wiring*, 6th Edition 1970, American Technical Society, Chicago, Illinois.

Johnson, Robert C., *Electrical Wiring Design and Construction*, Prentice-Hall Inc., Englewood Cliffs, New Jersey, 1971.

Interior Climate Control
(ACR 101)

Hours Required: Class 3, Laboratory 3

Description: Interior Climate Control is a related course for the student who is not majoring in Air Conditioning and Refrigeration. The course will introduce the fundamentals of environmental control in home and industry. The types and components of air handling systems will be covered in an introductory manner.

Objective: The objective of this course is to familiarize the student with the climatic aspects of human comfort and the fundamental methods used in home and industry for achieving the most pollution free and comfortable environment.

I. Introduction to Air Conditioning
   - A. Temperature Control
   - B. Air Movement
   - C. Moisture Content
   - D. Air Purification
   - E. Ventilation

II. Psychrometrics
   - A. Psychrometric Chart
     1. Uses
     2. Method of Reading
   - B. Terminology
   - C. Humidity
     1. Absolute
     2. Specific
     3. Relative
   - D. Effective Temperature
   - E. Human Comfort Zone
     1. Winter comfort zone
     2. Summer confort zone
   - F. Condensation and Dewpoint
   - G. Psychometric Patterns
     1. Latent heat
     2. Sensible heat
   - H. Air Mixture

III. Principles of Heat Load Estimating
- A. Conducted Heat
- B. Radiated Heat or Solar Heat
- C. Human Body Heat
- D. Electrical Appliance
- E. Heat of Ventilation Air

IV. Air Distribution
- A. Ducts
  1. Air ducting
  2. Water ducting
- B. Fans
  1. Fan velocity
  2. Noise level
- C. Duct materials
  1. Metal
  2. Fiberglass
  3. Metalpiping
- D. Duct Fittings
- E. Overhead Systems
- F. Floor Systems
- G. Outlets or Registers
- H. Duct System Selection

V. Applied Load Estimating
- A. Type of Construction
- B. Load Estimate
- C. Equipment Selection
  1. Heating
  2. Cooling
  3. Humidifying
  4. Dehumidifying

VI. Residential and Commercial Equipment
- A. Window Units
  1. Cooling
  2. Cooling & heating (electrical)
  3. Heat pumps
- B. Central Systems
  1. Water circulating system
  2. Blown air system

C. Compressor and Condenser Structure
   1. Air cooled
   2. Water cooled
   3. Static

VII. Air Condition Controls
   A. Temperature Sensing
      1. Heating thermostat
      2. Cooling thermostat
      3. Heating-cooling thermostat
   B. Fan Control
   C. Energy Control

VIII. Balancing the System
   A. Heating Balance
      1. Kitchen
      2. Bedroom
      3. Common areas
   B. Cooling Balance
      1. Kitchen
      2. Bedroom
      3. Common areas

Text: Weaver, Michael K., and Kirkpatrick, James, *Environmental Controls*, Harper and Row, 1974.

References: Althouse, Turnquist, Bracciano, *Modern Refrigeration and Air Conditioning*, Goodheart-Wilcox Company, Homewood, Illinois, 1968

Long, V. Paul, *Principles of Air Conditioning*, Delmar Publications, Albany, New York, 1968.

Schweitzer, Gerald, Ebeling, A.: *Basic Air Conditioning*, Volumes 1 & 2, 1971, Hayden Book Company, Inc., New York, N.Y.

Isometric Drawing
(DRT 102)

Hours Required: Class 2, Lab 3

Description: Course designed specifically to acquaint student with the fundamentals of drafting. Emphasis is placed on basics, isometrics, and free-hand sketching.

Objectives: To enable student to readily prepare on-site drawings or sketches for use in construction technology and to allow the student to prepare drawings of projects from blueprints and verbal description and specifications.

I. Basics of Drafting
   - A. Tools Used
   - B. Line Development
     1. Types of lines
   - C. Symbols and Their Uses
   - D. Basic Labeling and Lettering
   - E. Scale and Proportion
   - F. Templates

II. Orthographic Projection
   - A. Definition of Orthographic
   - B. Arrangement of Face Views
   - C. Dimensions
   - D. Drawing Face Views
     1. Three-dimensional solids
     2. Order of line drawing
        - a. Visible lines
        - b. Hidden lines
        - c. Center lines
     3. Drawing house designs
        - a. From blueprints
        - b. With modification or addition

III. Isometric Drawing
   - A. Definition of Isometric
   - B. Terms
     1. Plane of projection
     2. Views

C. Use of Templates and Gridpaper

D. Isometric Taxes

E. Basic Shapes
   1. Cube and rectangular solid
   2. Cylinder, cone, circle, and ellipse
   3. Pyramids and other solids
   4. Combinations of shapes
   5. Spheres
   6. Common errors

F. Making Room Drawings
   1. From blueprints
   2. From verbal description

G. Offset Construction
   1. Isometric triangles
   2. Complex solid shapes
   3. House designs

H. Other Construction
   1. Irregular curves
   2. Quarter rounds

IV. Pictorial Sketching

A. Proportion

B. Estimating Distances
   1. Applications of trigonometry
   2. Use of body measures
      a. Forefinger
      b. Hand
      c. Forearm
      d. Pace or step
      e. Foot
      f. Span of hand and arms

C. Two-Point Perspective Drawing
   1. Definition and uses
   2. Horizon line
   3. Vanishing point
   4. Drawing a cube
   5. Proportioning
   4. Drawing other figure
      a. Circle
      b. Cylinder
      c. Pyramid
      d. Sphere

7. Rendering
   a. Achieving shades or tones
   b. Use of a stump
   c. Film
   d. Achieving shadow and light source
8. Perspective grids
   a. Use in large drawings
   b. Drawings from blueprints
   c. Drawings from specifications

D. One-Point Perspective Drawing
1. Definition and uses
2. Drawing a cube
3. Other drawings
4. Construction drawings

E. On-Site Pictorial Sketching
1. Sketching from construction project
2. Sketching completed buildings

Text: Sinewitz, Jack, *Technical Graphics: A First Course*, Addison Wesley Publishing Co., Reading, Mass., 1973.

References: Olivo, *Blueprint Reading*, Delmar Publications, Albany, New York.

Thomas, T. A., *Technical Illustrations*, McGraw-Hill Book Company, Inc., New York, N.Y.

Small Business Management I
(BUS 104)

Hours Required: Class 3, Lab 0

Description: The course describes the scope of small business and the nature of problems of small business. Practical means of dealing with marketing problems, financial problems, and other types of problems of small business are explained.

Major Divisions:

I. Small Business in the American Economy
II. A Management Philosophy – Ethics
III. Management Functions
IV. Causes of Small Business Failure
V. Characteristics of the Entrepreneur
VI. Legal Aspects of Small Business
VII. Initial Financial Planning
VIII. Locating the Enterprise
IX. Physical Facilities
X. The Organization
XI. Planning Operations
XII. Record Keeping
XIII. Budgeting
XIV. Risk and Insurance
XV. Contracts

Text: Broom H.N., and Longenecker, Justin, *Small Business Management*, 3rd ed., South-Western, Cincinnati, 1971; also, a workbook by Longenecker, *Student Supplement of Small Business Management*, 3rd ed., South-Western, Cincinnati, Ohio, 1971.

Surveying
(ENS 104)

Hours Required: Class 2. Laboratory 3

Description: A course designed to deal with surveying, including the fundamentals of plane surveying and the use and care of equipment. Accurate measuring of distance, theory and practice of leveling, angles and bearings, principles and use of the transit, curves, stadia, and topographic and land surveying are coordinated in class, laboratory, and field experiences.

Objective: To enable the student to become competent in measuring distance, leveling, and determining angles and bearings. The student will develop a competence in the use, adjustment, and care of the equipment and instruments used in surveying.

All procedures will be carried out with meticulous attention given to accuracy.

I. Introduction
   A. Class
      1. Definition of surveying
      2. Kinds and classes of surveys
      3. Precision
      4. Field notes
      5. Errors and mistakes
         a. Distinction between errors and mistakes
         b. Distinction between precision and errors
         c. Classes of errors
         d. Reduction of errors
      6. Relation between angles and distances

II. Measurement of Distance
   A. Class
      1. Units of length
      2. Instruments
         a. Steel and metallic tapes
         b. Steel pins
         c. Spring balances and clamp handle
         d. Range poles
         e. Care of equipment
      3. Pacing and stadia method
      4. Measuring with steel tape on level ground
      5. Measuring with steel tape on sloping or uneven ground

6. Errors in taping
   a. Incorrect length
   b. Temperature
   c. Slope and alignment
   d. Setting pins
   e. Tension and wind
7. Mistakes in taping
   a. Omitted tape length
   b. Misreading the tape
   c. Calling and recording numbers
   d. One-foot mistakes
   e. Mistakes end marks
8. Checks
9. Accuracy, specifications, and note keeping

B. Field Problems (with accuracy within allowable limits of error)
1. Taping and pacing on level ground around a known traverse, forward and back
2. Taping a sloping ground
   a. Tape level, slope estimated
   b. Tape on ground, correction applied

III. Leveling

A. Class
1. Need for relative elevation of points on earth's surface
2. General principles
3. Earth's curvature and atmospheric refraction
4. Three methods of leveling
5. The Engineer's Level: Dumpy and Wye types
   a. Telescope
      (1) Objective lens
      (2) Eyepiece
      (3) Cross-hairs
      (4) Parallax
      (5) Magnification
   b. The bubble-tube
   c. The tangent and clamp screw
   d. Leveling screws and footplate
   e. Tripod
6. Level Rods
7. Care of equipment
   a. Carrying of instrument
   b. Screws and clamps
   c. The lenses
   d. Cross-hairs
   e. Moisture

8. Theory of leveling
   a. Bench mark
   b. Turning point
   c. Backsight
   d. Height of instrument
   e. Foresight
9. Field procedure
   a. Setting-up level
   b. Obtaining the field information
10. Differential leveling
   a. Complete and proper field notes
   b. Precautions to observe
   c. Signals used by members of party
11. Adjustment of the engineers level
   a. Relations that should exist
   b. Adjustment of the cross-hair ring
   c. Adjustment of the bubble tube
   d. Adjustment of the line of sight
12. Sources of error in leveling
   a. Non-adjustment of instrument
   b. Bubble not centered
   c. Incorrect reading of rod
   d. Rod not plumb
   e. Incorrect rod length
   f. Parallax
   g. Curvature of the earth
   h. Heat waves and wind
   i. Setting of instrument
   j. Poor turning points
13. Mistakes commonly made in leveling
   a. Misreading the rod
   b. Recording and computing
14. Checks
15. Accuracy and specifications

B. Field Problems (with accuracy within allowable limits of error)
1. Differential level circuit (short)—1/4 mile
2. Differential level circuit (long)—1 1/2 miles
3. Test of instrument tests and results recorded
4. Profile leveling

IV. Angles and Bearings
A. Class
1. Definitions
2. Closed and open traverses
   a. Interior, exterior, deflection, re-entrant angles, and angle to the right

b. Bearings
   (1) Meridians
   (2) Magnetic bearing
   (3) True bearing
   (4) Azimuth
   (5) Declination

3. The compass and use
   a. Reading a bearing
   b. Calculating bearings and angles
   c. Sources of errors
      (1) Parallax
      (2) Needle
      (3) Local attractions
      (4) Variation of declination
   d. Mistakes
      (1) Misreading the quadrant
      (2) Transposing the quadrant letters
      (3) Misreading the circle
   e. Accuracy

Text: Kessam, Philip. *Surveying Practice*. 2nd Edition. McGraw-Hill Book Co., Inc., New York, N.Y., 1971.

References: Davis, Foote and Kelly. *Surveying Theory and Practice*. 5th Edition. McGraw-Hill Book Company, New York, N.Y., 1968.

SUPPORTING GENERAL EDUCATION COURSES

English I (ENG 101)
English II (ENG 102)
Introduction to Electricity and Magnetism (PHY 110)
Mathematics I (MAT 101)
Mathematics II (MAT 102)

English I
(ENG 101)

Hours Required: Class 3, Lab 0

Description: A semantics approach to communication. Students will examine the functions, influences, and subtleties of language. Writing will be emphasized as an important means of communication; therefore, students will write frequently both in and out of class. Regular attention will be paid to overcoming students' writing problems including those concerning purpose, clarity, organization, and mechanics.

Objectives: To help students gain an understanding of the way language works.
To enable students to act on the basis of this understanding.
To help students to develop their abilities to communicate effectively.
To help students write clearly, fluently, and without mechanical errors.

I. Language: The Way It Works
   - A. A Word Doesn't Mean
   - B. The Symbol Is Not the Thing; The Word Is Not the Thing; The Map Is Not the Territory
   - C. Perceptions
   - D. Contexts
   - E. Non-Verbal Communication
   - F. Connotation and Slant
   - G. Report, Inference and Judgment
   - H. The Little Man Who Wasn't There

II. Communication: The Written Work
   - A. Writing Experiments
   - B. Writing Exercises
   - C. Required Themes
   - D. Elements of Technical Writing and Reporting

III. Writing: Ease, Organization and Mechanics
   - A. Using Nouns and Verbs
   - B. Spelling Demons

Note: The course will not be divided into parts; rather, these three aspects of the course will be dealt with concurrently.

C. Building a Sentence

D. Building a Paragraph

E. Building an Essay
   1. Reports
   2. Estimates
   3. Specifications

F. Basic Problems in Punctuation

G. Copyreading

Text: Bigby, John and Hill, Russel, *Options: A Program for English*, Boston: Houghton Mifflin Co., 1972.

Note: Students should obtain a dictionary for both home and class use.

Related and recommended reading:

Fabun, Don, Communications: *The Transfer of Meaning*, Beverly Hills, California: The Glencoe Press, 1968.

Hayakawa, S.I., *Language in Thought and Action*, Harcourt, Brace & Jovonovitch.

Maroon, John L., *Writer's Review*, Glenview, Illinois: Scott, Foresman & Co., 1968.

Troyka, Lyn Q. & Jerrold Nudlman, *Steps in Composition*, Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1970.

Watt, William W., *An American Rhetoric*, New York: Holt, Rinehart & Winston, 1970.

English II
(ENG 102)

Hours Required: Class 3, Lab 0

Description: A continuation of English 101, this course will deal with more formal composition, as well as communication peculiar to the students' specialization program. There will be emphasis on clear thinking and organization. Paragraph and essay development, definition and development of a topic and the research paper will be covered. Also included will be some opportunity for oral presentations.

Objectives: To help students write fluently and clearly without mechanical errors. To help students organize and present their ideas clearly and logically. To help students communicate effectively in their daily lives and in their work.

I. Organization and Clear Thinking
   - A. Forming the Thesis
   - B. Limiting the Topic
   - C. Logical Development
   - D. Fallacies in Reasoning
   - E. Revising for Organization

II. Paragraphs
   - A. Paragraph Development
   - B. Transition
   - C. Paragraph Revision

III. Sentences
   - A. Simple, Clear Structure
   - B. Variety
   - C. Devices of Rhetorical Effectiveness
   - D. Sentence Revision

Note: Specialized study will be interspersed throughout the semester with work in writing and other aspects of the course. It will deal with those aspects of communication peculiar to the student's program.

IV. Words
- A. Action
- B. Precision
- C. Economy
- D. Concreteness

V. The Research Paper
- A. Choosing the Topic
- B. Limiting the Topic
- C. Preliminary Research
- D. Thesis Statement
- E. Note Taking
- F. Outlining
- G. Footnotes
- H. Bibliography

VI. Practical Writing
- A. Writing Business Letters
- B. Preparing a Written Estimate
- C. Letters of Application and Resumes
- D. Writing Correctly
  1. Review of punctuation, sentence sense, elements of grammar and usage
  2. Spelling
     - a. Demons
     - b. Using a dictionary

Text:

Corbett, Edward P.J., *The Little English Handbook: Choices and Conventions*, John Wiley & Sons, Inc., New York, 1973.

Cox, R. David, *Composition: Getting the Job Done*, Holbrook Press, Inc., Boston, Mass., 1970.

Gavin, Ruth E., & Sabin, William A., *Reference Manual for Stenographers and Typists*, McGraw-Hill Book Co., New York.

Related Reading:

Draper, Lowell A., *A Curse on Confusion*, Westinghouse Learning Corporation.

Fear, David E., *Technical Writing*, Random House.

Fergus, Patricia M., *Spelling Improvement: A Program for Self-Instruction*, McGraw-Hill Book Co.,

Fife, Jim and Carstens, William F., *A Practical Approach to Writing*, Scott, Foresman & Co.,

Flesch, Rudolph, *How to Write, Speak and Think More Effectively*, Harper and Row.

Maroon, John L., *Writer's Review*, Glenview, Illinois: Scott, Foresman & Co., 1968.

Warriner, John, *A Handbook of English Grammar and Composition*, Harcourt, Brace & Co.

Introduction to Electricity and Magnetism
(PHY 110)

Hours Required: Class 2, Laboratory 3

Description: An introductory course in the study of electricity beginning with the electrical structure of matter, and covering the topics of magnetism, conductors, Ohms Law, motors, generators, and circuits. Classroom theory is supported by practical applications in laboratory experiments and written reports.

Objective: To provide the student with an understanding of the fundamentals of electricity, and a practical knowledge of its application. Through laboratory experimentation and demonstration, the student is assured of a thorough understanding of the principles presented in classroom lectures. Upon completion of this course, the student will have obtained a knowledge of the modern concepts of electricity and the ability to utilize this information with problems relating to circuits and equipment.

I. Electrical Make-Up of the Universe
   - A. Compounds, Elements, and Atoms
   - B. Atomic Structure
   - C. Static Electricity
   - D. Law of Charges

II. Magnetism
   - A. Magnetic Materials
   - B. Magnet Fields
   - C. Magnetic Shield
   - D. Laws of Magnetism

III. Conductors and Non-Conductors
   - A. Wire Sizes
   - B. Types of Insulators
   - C. Circuit Symbols

IV. Voltage, Current, and Resistance
   - A. Electrical Potential
   - B. Electron Flow in Circuits
   - C. Limiting Current Flow
   - D. Heat Dissipation in Circuits

V. Ohm's Law
   A. Determining Electrical Values
   B. Wattage Calculations
   C. Circuit Components

VI. The Generator
   A. Inducing Voltage
   B. Types of Generators
   C. D.C. and A.C. Current
   D. Generator Losses

VII. Series and Parallel Circuits
   A. Wiring Requirements
   B. Series Circuits
   C. Parallel Circuits
   D. Series-Parallel Circuits

VIII. Electrical Measuring Instruments
   A. Ammeters
   B. Voltmeters
   C. Ohmmeters
   D. Wattmeters

IX. Motors
   A. Motor Design and Operation
   B. Commutation and Interpoles
   C. Counter E.M.F.
   D. Types of Motors

X. A.C. Electricity
   A. Frequency and Amplitude
   B. "Average" Voltage and Current
   C. R.M.S. Voltage and Current
   D. Phase Relationships

XI. Inductance and Capacitance
   A. Units of Inductance
   B. Mutual and Self Induction
   C. R.L. Time Constants
   D. Units of Capacitance
   E. R.C. Time Constants

XII. Transformers

A. Coefficient of Coupling

B. Transformer Losses

C. Turns Ratio

D. Impedance Matching

Text: Kaufman, Milton, and Wilson, J.A., *Basic Electricity: Theory and Practice*; McGraw-Hill Book Company, New York, 1973.

References: Cornetet, Wendell H., *Principles of Electricity*; McKnight and McKnight, Bloomington, Illinois, 1962.

Marcus, Abraham, *Electricity for Technicians*; Prentice-Hall, Englewood Cliffs, New Jersey, 1968.

Mathematics I
(MAT 101)

Hours Required: Class 3, Lab 0

Description: A course concerning the essential parts of arithmetic, systems of measurement, and fundamental algebraic operations. The concepts of mathematics taught will complement the skills required of the building construction technician.

Objectives: To prepare the building construction technologist with a comprehensive background in mathematics with particular applications in building construction technology. The student will be able to use arithmetic and fundamental algebraic concepts for problems solving related to the technology and other situations.

I. Operations with Numbers
   - A. Review of Basic Operations
     1. Review of skills in addition, subtraction, multiplication, and division.
     2. Computation of board feet measure (fbm).
     3. Computation of measurement from a blueprint drawing.
   - B. Review of Fractional Numbers
     1. Review of basic operations.
     2. Measurements from blueprints.
     3. Lumber widths.
   - C. Review of Decimal Numbers
     1. Review of basic operations.

II. Application of percent
   - A. Meaning of Percent
   - B. Conversion of Fractional and Decimal Numbers
   - C. Practical Uses
     1. Tax
     2. Commission
     3. Discount
     4. Profit and loss
     5. Waste factor of building materials

III. Measurement and Dimensional Relationships
   - A. Units of Measurement
   - B. The English System
   - C. The Metric System
   - D. Conversion of Measures

E. Square Measures in Both Systems

F. Dimensional Analysis

IV. Signed Numbers

A. Positive and Negative Numbers

B. Equality and Inequality

C. Applications with Signed Numbers

V. Squares and Roots

A. Definition of a Square and a Root.

B. Pythagorean Theorem

1. Theorem definition
2. Solving right triangle
3. Rafter length
4. Valley rafter length

VI. Algebraic Operations

A. Algebraic Terminology

B. Evaluation of Expressions

C. Basic Operations

1. Similar terms
2. Exponents
3. Monomials

D. Solving Simple Linear Equations

1. Equations using basic operations
2. Pitch equation
3. Number of steps required between floors

Mathematics II
(MAT 102)

Hours Required: Class 3, Lab 0

Description: An advanced course combining the concepts of algebra, trigonometry, and geometry with emphasized applications.

Objectives: To develop a high degree of mathematical skill and thorough understanding of the skills in mathematics that are required in the technology.

I. Linear Equations
   - A. Review of Simple Linear Equations
   - B. Solving Word Problems
   - C. Graphing
     1. Definition of slope
     2. Graphing by Slope-Intercept method

II. Simultaneous Equations
   - A. Solution by Graphing
   - B. Solution by Addition Method
   - C. Solution by Other Methods

III. Factors and Factoring
   - A. Common Terms
   - B. Quadratic Binomials
     1. Difference of two squares
   - C. Quadratic Trinomials
     1. Factoring
     2. Completing the square

IV. Quadratic Equations
   - A. Solution by Factoring
   - B. Solution by Completing the Square
   - C. Quadratic Formula

V. Construction of Angles
   - A. Approximate Values
   - B. Types of Angles
   - C. Interpolation
   - D. Angular Construction

VI. Trigonometric Equations
- A. Definition of Trigonometric Ratios
- B. Use of Trigonometric Tables
- C. Uses of Trigonometric Ratio
  1. Building height
  2. Non-measurable distances
  3. Pitch of roof

VII. Elements of Geometry
- A. Points and Lines
- B. Triangles
- C. Polygons and Quadrilaterals
- D. Circles

VIII. Perimeters and Areas
- A. Areas of Triangles
- B. Areas of Quadrilaterals
- C. Areas of Regular Polygons
- D. Areas of Circles
  1. Circles
  2. Arc, sector, segment
- E. Irregular Polygons
  1. Floor spaces for buildings

IX. Surface Areas and Volumes
- A. Geometric Solids
- B. Volume and Surface
- C. Volume and Surface Area of a Right Prism
- D. Volume and Surface Area of a Right Cylinder

APPENDICES

APPENDIX A

Bibliography

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Dalzell, J. Ralph, *Building Trades Blueprint Reading*, American Technical Society, Chicago, Illinois, 1956.

Davis, Raymond, *Short Course in Surveying*, McGraw-Hill, New York, N.Y.

Dubin, Robert, *The World of Work*, Prentice-Hall, Inc., Englewood Cliffs, N.J.

Emerick, Robert, *Heating Handbook*, McGraw-Hill, N.Y., 1964.

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APPENDIX C

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B.O.C.A., *Basic Building Code*, Latest Edition, Building Official Conference of America Inc.

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Appendix D

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"Architectural Drafting" (Transparency Set). DCA Educational Products, Inc., Warrington, Pennsylvania.

"Carpentry" (Transparency Set). Learning Arts. Wichita, Kansas

"Electric House Wiring" (8mm movie) Learning Arts. Wichita, Kansas.

"Hanging a Door" (Film Loop Series). Visual Instruction Production. Alesco, Paramus, N.J.

"Isometric Drawing" (Transparency Set) DCA Educational Products, Inc., Warrington, Pennsylvania.

"Mechanical Drawing" (Filmstrip Series) Learning Arts. Wichita, Kansas.

"Modern American Architecture" (Slides) Curriculum Enrichment Media Programs, Alesco, Paramus, N.J.

"Orthographic Projection" (Transparency Set) DCA Educational Products Inc., Warrington, Pennsylvania.

"Residential Electric Wiring" (Transparency Set) DCA Educational Products, Inc., Warrington, Pennsylvania.

"Saws: Types" (Film Loop) Visual Instruction Productions, Alesco, Paramus, N.J.

"Wood Technology" (Transparency Set) DCA Educational Products Inc., Warrington, Pennsylvania.